Citation:

Moore LL, Bradlee ML, Gao D, Singer MR. Low dairy intake in early childhood predicts excess body fat gain. Obesity (Silver Spring). 2006 Jun;14(6):1010-8.

PubMed ID: 16861606

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To estimate the effect of dairy intake in early childhood on the acquisition of body fat from 5 to 13 years of age.

Inclusion Criteria:

- Children between 3 to 6 years old

Exclusion Criteria:

- Excluded if not included above

Description of Study Protocol:

Recruitment: Children belonged to the Framingham Children's Study. They were recruited in 1987 from a two-parent families and followed until 1999.

Design: Prospective Cohort Study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis:

- Child's mean daily serving of dairy products were calculated in early childhood by the average of all servings per day from all diet records collected before six years old. The number of days of diet records completed for the children before age six was fifteen

- The exposure variable was early childhood to provide both an unbiased estimate of intake and to classify the children more accurately, thus maximizing the ability to detect between-group differences
- Change in body fat was estimated by calculating a slope for each anthropometry outcome for each child. For each measurement per child it was chose a slope from ages 5 to 13. Thus, the slopes estimated using age 5 as the anchor point more closely follow the assumption of linearity
- Mean body fat in adolescence was estimated as the mean of all available measures taken between 10 and 13 years of age
- Distribution of early childhood dairy intake was divided in tertiles, separately for girls and boys
- ANOVA and analysis of covariance
- Student's T test was used to compare anthropometry means in the highest and lowest tertiles of dairy intake
- Potential confounding was assessed by comparing the crude and adjusted mean anthropometry outcomes after controlling for the potential confounders such as age, physical activity, baseline anthropometry, maternal education, energy intake per day, and percentage of calories from saturated fat. Models including hours of TV viewing and intakes of fiber, whole grains, fruits and vegetables, and sugar-sweetened beverages yielded adjusted mean estimates that were generally within one decimal of the simpler models and no attenuation of the effects
- Inclusion of maternal BMI in a subanalysis

Data Collection Summary:

Timing of Measurements:

- Questionnaires and interviews about parents' health, activity, dietary habits, attitudes, beliefs, other risk behaviors, and also information on the child's diet and activity were measured at baseline and every year during 12 years (1987 to 1999).
- Anthropometric measurements and clinic exams were performed yearly.
- Physical activity was monitored and estimated on one to four separate occasions each year.
- The dietary intake was collected by four sets of 3-day records during the first year of the study, and in each subsequent year, one or two sets of 3-day records were collected.

Dependent Variables

- Body fat gain throughout childhood - The sum of triceps, subscapular, suprailiac, and abdominal skinfolds were taken as a marker of body fat gain
- BMI (kg/m^2): calculated from measured height (to nearest 0.25 inch using measuring bar on scale) and weight (to nearest 0.25 pound using a standard counterbalance scale)

Independent Variables

- Dairy intake at early childhood: The dietary intake was assessed repeatedly using 3-day diet records.Dairy intake was derived from mean of 15 days of diet records per subject collected before age 6. During the early years of the study,parents completed all diaries for the children as well as their own diaries. The nutritionist instructed each family in the completion of the diaries, including how to use common household measures to estimate portion sizes. In later years, the child assisted in the collection of the dietary data. NDS-

University of Minnesota was used to calculate mean intakes of macro- and micronutrients. When estimating child's daily intake of dairy and other foods, it was used the U.S.D.A's Food Guide Pyramid serving definitions. Data was combined from the child's food records with the food pyramid serving database available through the technical files of the USDA's Continuing Survey of Food Intake by Individuals. The CSFI was matched with foods in the NDS by linking their food codes

Control Variables

- Parents's education level, BMI, age and activity
- Children age, sex and activity
- Total calories intake
- Calories from fat, saturated fat, carbohydrates and protein
- Calcium intake
- Magnesium intake

Description of Actual Data Sample:

Initial N: 92 (56M; 36F)

Attrition (final N): 92 (56M; 36F)

Age: 3 to 6 years

Ethnicity: not reported

Other relevant demographics: Parental education levels were lowest in the highest dairy intake group. Parental ages and activity were similar regardless level of dairy intake. At baseline, there was a tendency for the child's activity increased with increasing tertile of dairy intake.

Anthropometrics: At baseline, the children's BMI did not change with the increase of dairy intake, however the sum of four skinfold measurements increased with increasing tertile of dairy intake.

Location: Boston, MA

Summary of Results:

Key Findings

- Children in the lowest sex-specific tertile of dairy intake during preschool (<1.25 servings per day for girls and <1.70 servings per day for boys) had significantly greater gains in body fat during childhood.
- By the time of early adolescence, those in the lowest tertile of dairy intake had a BMI that was approximately two units higher and an extra 25 mm of subcutaneous fat

- **Effects of preschool dairy intake on slope of anthropometry from preschool to early adolescence (5 to 13 years old) adjusted for age, activity, mother's education, baseline**

anthropometry, energy intake and percentage of energy from saturated fat

Dairy servings per day (3 to 6 years old)	BMI	Triceps	Subscapular	Suprailiac	Abdominal	Sum of four SFs
Dairy (sex-specific tertile) Tertile 1	0.83±0.09	1.40±0.18	1.53±0.23	2.97±0.33	2.85±0.29	8.82±0.93
Tertile 2	0.52±0.09	0.97±0.16	0.94±0.21	1.78±0.31	1.60±0.27	5.46±0.87
Tertile 3	0.59±0.09	1.09±0.18	0.81±0.23	1.86±0.33	1.40±0.29	4.94±0.94
*P	0.083	0.242	0.043	0.030	0.002	0.008

*Comparison of group 1 vs group 3

- **Effects of preschool dairy intake on anthropometry level in early adolescence (ages 10 to 13 years) after adjusting for child's age, sex, physical activity, energy intake, percentage of energy from saturated fat baseline anthropometry and mother's education**

Dairy servings per day (3 to 6 years old)	BMI	Triceps	Subscapular	Suprailiac	Abdominal	Sum of four SFs
Dairy (sex-specific tertile) Tertile 1	21.1±0.6	20.2±1.1	14.6±1.4	23.2±2.0	23.9±1.8	82.48±5.8
Tertile 2	18.8±0.6	16.4±1.0	10.6±1.3	14.8±1.9	15.2±1.7	57.9±5.4
Tertile 3	19.3±0.6	16.7±1.1	10.8±1.5	16.1±2.0	14.8±1.8	57.2±5.8
*P	0.046	0.032	0.084	0.021	0.002	0.005

*Comparison of group 1 vs group 3

- Adjusted mean differences in sum of four SFs according to dairy intake

Dairy servings per day (3 to 6 years of age)	Mean differences in sum of four SFs	
	Slope:age 5 to 13 yearslllllllllllll mean (95%CI)	Mean SFs:age 10 to 13 yearslllllll mean (95%CI)
Dairy (sex-specific tertile):adjusted model&		

Tertile 1*		
Tertile 2	-3.36 (-5.73, -0.98)	-24.54 (-39.23, -9.8)
Tertile 3	-3.88 (-6.53, -1.23)	-25.16 (-41.54, -8.79)
Dairy (sex-specific tertile):adding dietary calcium (mg) to the adjusted model Tertile 1*		
Tertile 2	-4.2 (-6.83, -1.57)	-29.14(-45.32, -12.96)
Tertile 3	-5.89 (-9.76, -2.03)	-36.55 (-60.43, -12.67)
Dairy (sex-specific tertile): adding dietary magnesium (mg) to the adjusted model		
Tertile 1*		
Tertile 2	-3.29 (-5.76, -0.90)	-23.14(-37.82, -8.45)
Tertile 3	-3.63 (-6.47, -0.79)	-21.18 (-38.42, -3.93)

*Reference category; & adjusted for age, activity, energy intake, percentage of calories from saturated fat, mother's education, and baseline anthropometry.

Other Findings

- Total energy increased in a linear fashion as dairy intake increased (1464±164; 1519±222; 1723±330 kcal/day) from the lowest to highest tertile, respectively
- Children with lowest dairy intakes consumed proportionately fewer of their total calories as fat (32.2±5.0;34.4±4.0; 34.1±3.8 g %); saturated fat (12.0±2.6; 13.2±1.8; 13.7±1.9 g %) and protein (12.7±1.8; 13.4±1.4; 14.2±1.4 g%); however more carbohydrates (56.7±5.9; 53.8±4.7; 53.3±4.2 g%) from the lowest to highest tertile, respectively
- Girls had a median intake of 1.09, 1.59, and 2.01 servings of dairy per day in the lowest to highest intake tertile, respectively, whereas boys consumed 1.38, 2.03, and 2.84 servings per day. The cut off point for girls were 1.25 and 1.85 servings per day; for boys 1.70 and 2.35 servings per day
- Adolescent body fat was lowest for those consuming ≥ 1.75 servings per day of reduced-fat dairy

Author Conclusion:

Suboptimal dairy intakes during preschool in this cohort were associated with greater gains in body fat throughout childhood.

Reviewer Comments:

Limitation recognized by the authors:

- *The Framingham Children's Study is a small study, and although the families were followed intensively, the ability to stratify the data by factors such as gender or other lifestyle or dietary factors is very limited*

Other limitations:

- *Self reported diet record, eventhough they were in a large number (15 days of diet records per child) during the period of the study*
- *Rate of response is not clear*
- *Boys represented approximately sixty per cent of the total population, therefore, results may not be generalizable*
- *Protein intake was not included in the multivariable models as one of the factors that may explain the protective effect of higher dairy intakes*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions			
1.	**Was the research question clearly stated?**		Yes
	1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
	1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
	1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**		No
	2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	No
	2.2.	Were criteria applied equally to all study groups?	N/A

	2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
	2.4.	Were the subjects/patients a representative sample of the relevant population?	No
3.	**Were study groups comparable?**		Yes
	3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
	3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
	3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
	3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
	3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
	3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**		No
	4.1.	Were follow-up methods described and the same for all groups?	Yes
	4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	No
	4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
	4.4.	Were reasons for withdrawals similar across groups?	???
	4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**		N/A
	5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
	5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A

	5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
	5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
	5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**		Yes
	6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
	6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
	6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
	6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
	6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
	6.6.	Were extra or unplanned treatments described?	N/A
	6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
	6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**		Yes
	7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
	7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
	7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
	7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
	7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
	7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes

	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	???
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes